

Claims

1. A packet retransmission system which includes a transmission apparatus for transmitting a packet where a sequence number is added, a reception apparatus connected to the transmission apparatus through a network, and a request application unit connected to the reception apparatus, for retransmitting the packet where the sequence number is added between the transmission apparatus and the reception apparatus at a loss of the packet in packet transmission, the transmission apparatus comprising:

a retransmission buffer for storing the packet having been transmitted to the reception apparatus;

retransmission-request receiving means for identifying the sequence number and a largest (latest) sequence number provided to the request application, in a retransmission-request packet received from the reception apparatus, and notifying the sequence number and the largest (latest) sequence number;

retransmission packet detecting means for detecting whether a notified sequence number exists in the retransmission buffer; and

retransmission means for retransmitting all packets detected by the retransmission packet detecting means to the reception apparatus.

2. A packet retransmission system which includes a transmission apparatus for transmitting a packet where a sequence number is added, a reception apparatus connected to the transmission apparatus through a network, and a request application unit connected to the reception apparatus, for retransmitting the packet where the sequence number is added between the transmission apparatus and the reception apparatus at a loss of the packet in packet transmission, the reception apparatus comprising:

a reception buffer for storing the packet received from the transmission apparatus;

receiving means for storing the packet received from the transmission apparatus in the reception buffer, with sorting the packet in order of the sequence number;

packet loss detecting means for detecting a loss of the packet;

retransmission sequence number adding means for sending an instruction to add the sequence number of a lost packet detected by the packet loss detecting means to a

retransmission-request list;

retransmission-request list managing means for adding the sequence number to the retransmission-request list based on the instruction to add;

5 retransmission-request transmitting means for putting the sequence number stored in the retransmission-request list, in a retransmission-request packet and sending the retransmission-request packet to the transmission means; and

packet providing means for providing the packet in the reception buffer to the request application unit.

10 3. A packet retransmission system which includes a transmission apparatus for transmitting a packet where a sequence number is added, a reception apparatus connected to the transmission apparatus through a network, and a request application unit connected to the reception apparatus, for retransmitting the packet where the sequence number is added between the transmission apparatus and the reception apparatus at a loss of the packet in packet transmission,
15 the transmission apparatus comprising:

a retransmission buffer for storing the packet having been transmitted to the reception apparatus;

retransmission-request receiving means for identifying the sequence number and a largest (latest) sequence number provided to the request application, in a retransmission-request packet received from the reception apparatus, and notifying the sequence number
20 and the largest (latest) sequence number;

retransmission packet detecting means for detecting whether a notified sequence number exists in the retransmission buffer; and

25 retransmission means for retransmitting all packets detected by the retransmission packet detecting means to the reception apparatus,

the reception apparatus comprising:

a reception buffer for storing the packet received from the transmission apparatus;

receiving means for storing the packet received from the transmission apparatus in
30 the reception buffer, with sorting the packet in order of the sequence number;

a packet loss detecting means for detecting the loss of the packet;

retransmission sequence number adding means for sending an instruction to add the sequence number of a lost packet detected by the packet loss detecting means to a retransmission-request list;

5 retransmission-request list managing means for adding the sequence number to the retransmission-request list based on the instruction to add;

retransmission-request transmitting means for putting the sequence number stored in the retransmission-request list, in the retransmission-request packet and sending the retransmission-request packet to the transmission apparatus; and

10 packet providing means for providing the packet in the reception buffer to the request application unit.

4. The packet retransmission system of claim 3,
the transmission apparatus including:

15 retransmission packet storing means for storing one of a specific packet and a packet to be retransmitted at packet loss, in the retransmission buffer, and

retransmission means for retransmitting one of the specific packet and the packet to be retransmitted at packet loss,

20 the reception apparatus including:

receiving means for receiving one of the specific packet and the packet to be retransmitted at packet loss, and storing one of the specific packet and the packet to be retransmitted at packet loss, with sorting in order of the sequence number, in the reception buffer.

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5. The packet retransmission system of claim 2 , 3, or 4,
the reception apparatus including

retransmission-request list managing means for creating a retransmission-request list which stores a sequence number of a packet currently being requested to retransmit
30 and a sequence number of a packet to be requested retransmission at a next retransmission

request time, for adding and deleting the sequence number, and for switching a status of the packet of the sequence number stored in the retransmission-request list to be a retransmission request status.

5 6. The packet retransmission system of claim 2, 3, or 4,
the reception apparatus including:

packet loss detecting means for detecting a sequence number of a lost packet based on sequence number inconsistency of packets in the reception buffer, at packet receiving intervals depending upon a number of times of receiving packets and a receiving time,

10 retransmission sequence number adding means for sending an instruction to add the sequence number of the lost packet detected by the packet loss detecting means into the retransmission-request list, to the retransmission-request list managing means, and

retransmission-request notifying means for sending an instruction to make a status of the retransmission-request list "READY" indicating a waiting status for receiving a retransmission
15 packet, to the retransmission-request list managing means.

7. The packet retransmission system of claim 3 or claim 4,
the reception apparatus including

retransmission-request transmitting means for creating one retransmission-request packet
20 including at least one sequence number of packet to be retransmitted existing in the retransmission-request list, and transmitting the retransmission-request packet to the transmission apparatus,

the transmission apparatus including:

25 retransmission-request receiving means for extracting the sequence number in the retransmission-request packet received from the reception apparatus and notifying the sequence number;

retransmission packet detecting means for detecting whether the packet of notified sequence number exists in the retransmission buffer;

30 retransmission-request responding means for putting sequence numbers of all

packets detected by the retransmission packet detecting means in one retransmission-request response packet and transmitting the retransmission-request response packet to the reception apparatus; and

5 retransmission means for retransmitting all the packets detected by the retransmission packet detecting means to the reception apparatus.

8. The packet retransmission system of claim 3 or claim 4,
the reception apparatus including

10 retransmission-request transmitting means for creating a retransmission-request packet including the largest (latest) sequence number of packet provided to the request application unit by the packet providing means, and transmitting the retransmission-request packet to the transmission apparatus,

the transmission apparatus including:

15 retransmission-request receiving means for extracting the largest sequence number in the retransmission-request packet received from the reception apparatus and notifying the largest sequence number; and

20 retransmission buffer deleting means for deleting packets of sequence numbers smaller than the largest sequence number notified by the retransmission-request receiving means, from the retransmission buffer.

9. The packet retransmission system of claim 3 or claim 4,
the reception apparatus including

25 retransmission-request transmitting means for creating a retransmission-request packet including at least one sequence number of packet to be retransmitted existing in the retransmission-request list and the largest (latest) sequence number of packet provided to the request application unit by the packet providing means, and transmitting the retransmission-request packet to the transmission apparatus,

30 the transmission apparatus including:

retransmission-request receiving means for extracting the sequence number and the largest sequence number in the retransmission-request packet received from the reception apparatus, and notifying the sequence number and the largest sequence number, and

retransmission packet detecting means for detecting whether the packet of notified sequence number means exists in the retransmission buffer,

retransmission buffer deleting means for deleting packets of sequence numbers smaller than the largest sequence number notified by the retransmission-request receiving means, from the retransmission buffer;

retransmission-request responding means for putting sequence numbers of all packets detected by the retransmission packet detecting means in one retransmission-request response packet and transmitting the retransmission-request response packet to the reception apparatus; and

retransmission means for retransmitting packets detected by the retransmission packet detecting means to the reception apparatus.

10. The packet retransmission system of claim 3 or claim 4, the reception apparatus including:

retransmission-request response receiving means for receiving a retransmission-request response packet including the sequence number of the packet to be retransmitted, from the transmission apparatus; and

retransmission sequence deleting means for extracting the sequence number from the retransmission-request response packet, and sending an instruction to delete a same sequence number as an extracted sequence number from the retransmission-request list, to the retransmission-request list managing means.

11. The packet retransmission system of claim 3 or claim 4, the reception apparatus including:

retransmission-request response receiving means for receiving a retransmission-request response packet including the sequence number of the packet to be retransmitted, from the transmission apparatus;

retransmission sequence deleting means for extracting the sequence number from the retransmission-request response packet, and sending an instruction to delete a same sequence number as an extracted sequence number from the retransmission-request list, to the retransmission-request list managing means; and

retransmission-request response notifying means for sending an instruction to make a status of the retransmission-request list "ACTIVE" to the retransmission-request list managing means, where the ACTIVE indicates a status that no packet will be retransmitted from the transmission apparatus though retransmission of the packet whose sequence number is in the retransmission-request list has been requested.

12. The packet retransmission system of claim 2, 3, or 4,
the reception apparatus including:

packet providing means for providing payload (data) of at least one packet out of packets stored in the reception buffer to the request application unit,

deleting sequence numbers smaller than a sequence number of the packet, from the retransmission-request list,

providing payload of packet of next sequence number ($N + 1$) coming after a sequence number (N being a natural number) of a packet provided last time, within a specific time, and

when the packet of next sequence number ($N + 1$) does not exist in the reception buffer and is not inserted into the reception buffer within the specific time, notifying the request application unit of a loss of the packet to be provided.

13. The packet retransmission system of claim 8, claim 9, or claim 12,
the reception apparatus including

packet providing means, when a packet to be provided within a specific time does not exist in the reception buffer, for performing a packet loss detection and a retransmission-request transmission at least once within the specific time.

14. The packet retransmission system of claim 8, claim 9, or claim 12,

the reception apparatus including

packet providing means, when a status of the retransmission-request list is ACTIVE indicating a status that no packet will be retransmitted from the transmission apparatus though retransmission of the packet whose sequence number is in the retransmission-request list has been requested, and when a sequence number of a packet to be provided to the request application unit exists in the retransmission-request list, for judging that no packet will be retransmitted even if retransmission-request is performed, and notifying a requestor, without waiting for the specific time having passed, that the packet to be provided is lost.

15. The packet retransmission system of claim 3 or claim 4, for the packet transmission between the transmission apparatus and the reception apparatus at the loss of the packet, where a general sequence number is added to each of all packets and a priority sequence number is added to one of a specific packet and a packet to be retransmitted at packet loss, the transmission apparatus including:

retransmission packet storing means for storing one of the specific packet and the packet to be retransmitted at packet loss, in the retransmission buffer; and

retransmission means for retransmitting one of the specific packet and the packet to be retransmitted at packet loss,

the reception apparatus including

receiving means for receiving one of the specific packet and the packet to be retransmitted at packet loss, and storing one of the specific packet and the packet to be retransmitted at packet loss, with sorting in order of the general sequence number, in the reception buffer.

16. The packet retransmission system of claim 15, the reception apparatus including

retransmission list managing means for creating a retransmission list which stores the general sequence number of packet to be retransmitted, and adding and deleting the general sequence number.

17. The packet retransmission system of claim 15,

the reception apparatus including:

retransmission sequence number deleting means, when the general sequence
5 number of packet received by the receiving means exists in a retransmission list, for
sending an instruction to delete the general sequence number from the retransmission list
to retransmission list managing means;

packet loss detecting means for detecting a general sequence number of a specific
packet of high priority which has been lost and the general sequence number of the packet
10 to be retransmitted at packet loss, which has been lost, based on the general sequence
number and the priority sequence number of the packet in the reception buffer and of a
received packet, at packet receiving intervals depending upon a number of times of
receiving packets and a receiving time and at every loss of packet of high priority found
based on inconsistency of priority sequence numbers, and

retransmission sequence number adding means for sending an instruction to add the
15 general sequence number of the specific packet of high priority whose loss is detected by the
packet loss detecting means and the general sequence number of the packet to be retransmitted at
packet loss, whose loss is detected by the packet loss detecting means, into the retransmission
list, to the retransmission list managing means.

18. The packet retransmission system of claim 15,

the reception apparatus including

retransmission-request transmitting means for creating a retransmission-request packet
including at least one general sequence number of packet existing in the retransmission list, and
25 transmitting the retransmission-request packet to the transmission apparatus,

the transmission apparatus including:

retransmission-request receiving means for extracting the general sequence number in the
retransmission-request packet received from the reception apparatus and notifying the general
30 sequence number,

retransmission packet detecting means for detecting whether a packet of notified general sequence number exists in the retransmission buffer, and

retransmission means for retransmitting the packet of the general sequence number detected by the retransmission packet detecting means to the reception apparatus.

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19. The packet retransmission system of claim 15,
the reception apparatus including

retransmission-request transmitting means for creating a retransmission-request packet including a largest (latest) general sequence number of packet provided to the request application unit by the packet providing means, and transmitting the retransmission-request packet to the transmission apparatus,

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the transmission apparatus including:

retransmission-request receiving means for extracting the largest general sequence number in the retransmission-request packet received from the reception apparatus, and notifying the largest general sequence number; and

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retransmission buffer deleting means for deleting packets of general sequence numbers smaller than the largest general sequence number notified by the retransmission-request receiving means, from the retransmission buffer.

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20. The packet retransmission system of claim 15,
the reception apparatus including

retransmission-request transmitting means for creating a retransmission-request packet including at least one general sequence number in the retransmission list and a largest (latest) general sequence number of packet provided to the request application unit by the packet providing means, and transmitting the retransmission-request packet to the transmission apparatus,

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the transmission apparatus including:

retransmission-request receiving means for extracting the general sequence number

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and the largest general sequence number in the retransmission-request packet received from the reception apparatus and notifying the general sequence number and the largest general sequence number,

retransmission buffer deleting means for deleting packets of general sequence numbers smaller than the largest general sequence number notified by the retransmission-request receiving means, from the retransmission buffer,

retransmission packet detecting means for detecting whether the packet of notified general sequence number exists in the retransmission buffer, and

retransmission means for retransmitting packets of the general sequence numbers detected by the retransmission packet detecting means, to the reception apparatus,

21. The packet retransmission system of claim 15,
the reception apparatus including:

packet providing means for providing payload (data) of at least one packet out of packets stored in the reception buffer to the request application unit,

deleting general sequence numbers smaller than a general sequence number of the packet, from the retransmission-request list,

providing payload of packet of next general sequence number ($N + 1$) coming after a general sequence number (N being a natural number) of a packet provided last time, within a specific time, and

when the packet of next general sequence number ($N + 1$) does not exist in the reception buffer and is not inserted into the reception buffer within the specific time, notifying the request application unit of a loss of the packet to be provided.

22. The packet retransmission system of claim 20,
the reception apparatus including

packet providing means, when a packet to be provided within a specific time does not exist in the reception buffer, for performing a packet loss detection and a retransmission-request transmission several times within the specific time.

23. The packet retransmission system of claim 20,

the reception apparatus including

packet providing means, when a general sequence number of a packet to be provided does not exist in the retransmission list, for notifying the request application unit that the packet to be provided is lost, without waiting for the specific time having passed.

24. The packet retransmission system of claim 3 or claim 4,

the transmission apparatus including

priority information adding means for adding priority information to an optional packet p coming every m packets ($m \leq n$, m and n are natural numbers), wherein the priority information is information about packets of high priority and packets to be retransmitted at a packet loss, which are located in a range of n packets from the packet p, and for deciding values of m and n depending upon a network congestion status,

the reception apparatus including

packet loss detecting means for detecting a sequence number of a packet of high priority which has been lost and a sequence number of packet to be retransmitted at packet loss which has been lost, based on a packet in the reception buffer and sequence number of a received packet and on the priority information, at packet receiving intervals depending upon a number of times of receiving packets and a receiving time and at every loss of important packet found based on inconsistency of sequence numbers.

25. A packet retransmission method, including a transmission apparatus for transmitting a

packet where a sequence number is added, a reception apparatus connected to the transmission apparatus through a network, and a request application unit connected to the reception apparatus, for retransmitting the packet where the sequence number is added between the transmission apparatus and the reception apparatus at a loss of the packet in packet transmission, the transmission apparatus comprising:

a retransmission buffer for storing the packet having been transmitted to the reception apparatus;

a retransmission-request receiving step of identifying the sequence number and a largest (latest) sequence number provided to the request application, in a retransmission-request packet received from the reception apparatus, and notifying the sequence number and the largest (latest) sequence number;

5 a retransmission packet detecting step of detecting whether a notified sequence number exists in the retransmission buffer; and

 a retransmitting step of retransmitting all packets detected by the retransmission packet detecting step to the reception apparatus.

10 26. A packet retransmission method, including a transmission apparatus for transmitting a packet where a sequence number is added, a reception apparatus connected to the transmission apparatus through a network, and a request application unit connected to the reception apparatus, for retransmitting the packet where the sequence number is added between the transmission apparatus and the reception apparatus at a loss of the packet in packet transmission,

15 the reception apparatus comprising:

 a reception buffer for storing the packet received from the transmission apparatus;

 a receiving step of storing the packet received from the transmission apparatus in the reception buffer, with sorting the packet in order of the sequence number;

 a packet loss detecting step of detecting a loss of the packet;

20 a retransmission sequence number adding step of sending an instruction to add the sequence number of a lost packet detected by the packet loss detecting step to a retransmission-request list;

 a retransmission-request list managing step of adding the sequence number to the retransmission-request list based on the instruction to add;

25 a retransmission-request transmitting step of putting the sequence number stored in the retransmission-request list, in a retransmission-request packet and sending the retransmission-request packet to the transmission step; and

 a packet providing step of providing the packet in the reception buffer to the request application unit.

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27. A packet retransmission method, including a transmission apparatus for transmitting a packet where a sequence number is added, a reception apparatus connected to the transmission apparatus through a network, and a request application unit connected to the reception apparatus, for retransmitting the packet where the sequence number is added between the transmission apparatus and the reception apparatus at a loss of the packet in packet transmission,
5 the transmission apparatus comprising:

a retransmission buffer for storing the packet having been transmitted to the reception apparatus;

10 a retransmission-request receiving step of identifying the sequence number and a largest (latest) sequence number provided to the request application, in a retransmission-request packet received from the reception apparatus, and notifying the sequence number and the largest (latest) sequence number;

a retransmission packet detecting step of detecting whether a notified sequence number exists in the retransmission buffer; and

15 a retransmitting step of retransmitting all packets detected by the retransmission packet detecting step to the reception apparatus,

the reception apparatus comprising:

a reception buffer for storing the packet received from the transmission apparatus;

20 a receiving step of storing the packet received from the transmission apparatus in the reception buffer, with sorting the packet in order of the sequence number;

a packet loss detecting step of detecting a loss of the packet;

a retransmission sequence number adding step of sending an instruction to add the sequence number of a detected lost packet to a retransmission-request list;

25 a retransmission-request list managing step of adding the sequence number to the retransmission-request list based on the instruction to add;

a retransmission-request transmitting step of putting the sequence number stored in the retransmission-request list, in a retransmission-request packet and sending the retransmission-request packet to the transmission apparatus; and

a packet providing step of providing the packet in the reception buffer to the request application unit.

28. The packet retransmission method of claim 27,

5 the transmission apparatus including:

a retransmission packet storing step of storing one of a specific packet and a packet to be retransmitted at packet loss, in the retransmission buffer, and

a retransmitting step of retransmitting one of the specific packet and the packet to be retransmitted at packet loss,

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the reception apparatus including:

a receiving step of receiving one of the specific packet and the packet to be retransmitted at packet loss, and storing one of the specific packet and the packet to be retransmitted at packet loss, with sorting in order of the sequence number, in the reception buffer.

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29. The packet retransmission method of claim 26, 27, or 28,

the reception apparatus including

a retransmission-request list managing step of creating a retransmission-request list which stores a sequence number of a packet currently being requested to retransmit and a sequence number of a packet to be requested retransmission at a next retransmission request time, of adding and deleting the sequence number, and of switching a status of the packet of the sequence number stored in the retransmission-request list to be a retransmission request status.

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30. The packet retransmission method of claim 26, 27, or 28,

the reception apparatus including:

a packet loss detecting step of detecting a sequence number of a lost packet based on sequence number inconsistency of packets in the reception buffer, at packet receiving intervals depending upon a number of times of receiving packets and a receiving time;

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a retransmission sequence number adding step of sending an instruction to add the sequence number of the lost packet detected by the packet loss detecting step into the retransmission-request list, to the retransmission-request list managing step; and

5 a retransmission-request notifying step of sending an instruction to make a status of the retransmission-request list "READY" indicating a waiting status for receiving a retransmission packet, to the retransmission-request list managing step.

31. The packet retransmission method of claim 27 or claim 28,
the reception apparatus including

10 a retransmission-request transmitting step of creating one retransmission-request packet including at least one sequence number of packet to be retransmitted existing in the retransmission-request list, and transmitting the retransmission-request packet to the transmission apparatus,

15 the transmission apparatus including:

a retransmission-request receiving step of extracting the sequence number in the retransmission-request packet received from the reception apparatus and notifying the sequence number;

20 a retransmission packet detecting step of detecting whether the packet of notified sequence number exists in the retransmission buffer;

a retransmission-request responding step of putting sequence numbers of all packets detected by the retransmission packet detecting step in one retransmission-request response packet and transmitting the retransmission-request response packet to the reception apparatus; and

25 a retransmitting step of retransmitting all the packets detected by the retransmission packet detecting step to the reception apparatus.

32. The packet retransmission method of claim 27 or claim 28,
the reception apparatus including

a retransmission-request transmitting step of creating a retransmission-request packet including the largest (latest) sequence number of packet provided to the request application unit by the packet providing step, and transmitting the retransmission-request packet to the transmission apparatus,

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the transmission apparatus including:

a retransmission-request receiving step of extracting the largest sequence number in the retransmission-request packet received from the reception apparatus and notifying the largest sequence number; and

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a retransmission buffer deleting step of deleting packets of sequence numbers smaller than the largest sequence number notified by the retransmission-request receiving step, from the retransmission buffer.

33. The packet retransmission method of claim 27 or claim 28,

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the reception apparatus including

a retransmission-request transmitting step of creating a retransmission-request packet including at least one sequence number of packet to be retransmitted existing in the retransmission-request list and the largest (latest) sequence number of packet provided to the request application unit by the packet providing step, and transmitting the retransmission-request packet to the transmission apparatus,

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the transmission apparatus including:

a retransmission-request receiving step of extracting the sequence number and the largest sequence number in the retransmission-request packet received from the reception apparatus, and notifying the sequence number and the largest sequence number;

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a retransmission packet detecting step of detecting whether the packet of notified sequence number exists in the retransmission buffer;

a retransmission buffer deleting step of deleting packets of sequence numbers smaller than the largest sequence number notified by the retransmission-request receiving step, from the retransmission buffer;

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a retransmission-request responding step of putting sequence numbers of all packets detected by the retransmission packet detecting step in one retransmission-request response packet and transmitting the retransmission-request response packet to the reception apparatus; and

5 a retransmitting step of retransmitting packets detected by the retransmission packet detecting step to the reception apparatus.

34. The packet retransmission method of claim 27 or claim 28,
the reception apparatus including:

10 a retransmission-request response receiving step of receiving a retransmission-request response packet including the sequence number of the packet to be retransmitted, from the transmission apparatus; and

 a retransmission sequence deleting step of extracting the sequence number from the retransmission-request response packet, and sending an instruction to delete a same sequence
15 number as an extracted sequence number from the retransmission-request list, to the retransmission-request list managing step.

35. The packet retransmission method of claim 27 or claim 28,
the reception apparatus including:

20 a retransmission-request response receiving step of receiving a retransmission-request response packet including the sequence number of the packet to be retransmitted, from the transmission apparatus;

 a retransmission sequence deleting step of extracting the sequence number from the retransmission-request response packet, and sending an instruction to delete a same sequence
25 number as an extracted sequence number from the retransmission-request list, to the retransmission-request list managing step; and

 a retransmission-request response notifying step of sending an instruction to make a status of the retransmission-request list “ACTIVE” to the retransmission-request list managing step, where the ACTIVE indicates a status that no packet will be retransmitted from the

transmission apparatus though retransmission of the packet whose sequence number is in the retransmission-request list has been requested.

36. The packet retransmission method of claim 26, 27, or 28,

5 the reception apparatus including:

a packet providing step of providing payload (data) of at least one packet out of packets stored in the reception buffer to the request application unit,

deleting sequence numbers smaller than a sequence number of the packet, from the retransmission-request list,

10 providing payload of packet of next sequence number ($N + 1$) coming after a sequence number (N being a natural number) of a packet provided last time, within a specific time, and

when the packet of next sequence number ($N + 1$) does not exist in the reception buffer and is not inserted into the reception buffer within the specific time, notifying the request application unit of a loss of the packet to be provided.

37. The packet retransmission method of claim 32 claim 33, or claim 36,

the reception apparatus including

20 a packet providing step, when the packet to be provided within a specific time does not exist in the reception buffer, of performing a packet loss detection and a retransmission-request transmission at least once within the specific time.

38. The packet retransmission method of claim 32 claim 33, or claim 36,

the reception apparatus including

25 a packet providing step, when a status of the retransmission-request list is ACTIVE indicating a status that no packet will be retransmitted from the transmission apparatus though retransmission of the packet whose sequence number is in the retransmission-request list has been requested, and when a sequence number of a packet to be provided to the request application unit exists in the retransmission-request list, of judging that no packet will be

retransmitted even if retransmission-request is performed, and notifying a requestor, without waiting for the specific time having passed, that the packet to be provided is lost.

39. The packet retransmission method of claim 27 or claim 28, for the packet transmission
5 between the transmission apparatus and the reception apparatus at the loss of the packet, where a general sequence number is added to each of all packets and a priority sequence number is added to one of a specific packet and a packet to be retransmitted at packet loss, the transmission apparatus including:

a retransmission packet storing step of storing one of the specific packet and the
10 packet to be retransmitted at packet loss, in the retransmission buffer; and

a retransmitting step of retransmitting one of the specific packet and the packet to be retransmitted at packet loss,

the reception apparatus including

15 a receiving step of receiving one of the specific packet and the packet to be retransmitted at packet loss, and storing one of the specific packet and the packet to be retransmitted at packet loss, with sorting in order of the general sequence number, in the reception buffer.

20 40. The packet retransmission method of claim 39, the reception apparatus including

a retransmission list managing step of creating a retransmission list which stores the general sequence number of packet to be retransmitted, and adding and deleting the general sequence number.

25 41. The packet retransmission method of claim 39, the reception apparatus including:

a retransmission sequence number deleting step, when the general sequence number of packet received by the receiving step exists in a retransmission list, of sending
30 an instruction to delete the general sequence number from the retransmission list to

retransmission list managing step;

a packet loss detecting step of detecting a general sequence number of a specific packet of high priority which has been lost and the general sequence number of the packet to be retransmitted at packet loss, which has been lost, based on the general sequence number and the priority sequence number of the packet in the reception buffer and of a received packet, at packet receiving intervals depending upon a number of times of receiving packets and a receiving time and at every loss of packet of high priority found based on inconsistency of priority sequence numbers, and

a retransmission sequence number adding step of sending an instruction to add the general sequence number of the specific packet of high priority whose loss is detected by the packet loss detecting step and the general sequence number of the packet to be retransmitted at packet loss, whose loss is detected by the packet loss detecting step, into the retransmission list, to the retransmission list managing step.

42. The packet retransmission method of claim 39,
the reception apparatus including

a retransmission-request transmitting step of creating a retransmission-request packet including at least one general sequence number of packet existing in the retransmission list, and transmitting the retransmission-request packet to the transmission apparatus,

the transmission apparatus including:

a retransmission-request receiving step of extracting the general sequence number in the retransmission-request packet received from the reception apparatus and notifying the general sequence number;

a retransmission packet detecting step of detecting whether a packet of notified general sequence number exists in the retransmission buffer; and

a retransmitting step of retransmitting the packet of the general sequence number detected by the retransmission packet detecting step to the reception apparatus.

43. The packet retransmission method of claim 39,

the reception apparatus including

a retransmission-request transmitting step of creating a retransmission-request packet including a largest (latest) general sequence number of packet provided to the request application unit by the packet providing step, and transmitting the retransmission-request packet to the transmission apparatus,

the transmission apparatus including:

a retransmission-request receiving step of extracting the largest general sequence number in the retransmission-request packet received from the reception apparatus, and notifying the largest general sequence number; and

a retransmission buffer deleting step of deleting packets of general sequence numbers smaller than the largest general sequence number notified by the retransmission-request receiving step, from the retransmission buffer.

44. The packet retransmission method of claim 39,

the reception apparatus including:

a retransmission-request transmitting step of creating a retransmission-request packet including at least one general sequence number in the retransmission list and a largest (latest) general sequence number of packet provided to the request application unit by the packet providing step, and transmitting the retransmission-request packet to the transmission apparatus,

the transmission apparatus including:

a retransmission-request receiving step of extracting the general sequence number and the largest general sequence number in the retransmission-request packet received from the reception apparatus and notifying the general sequence number and the largest general sequence number;

a retransmission buffer deleting step of deleting packets of general sequence numbers smaller than the largest general sequence number notified by the retransmission-request receiving step, from the retransmission buffer;

a retransmission packet detecting step of detecting whether the packet of notified

general sequence number exists in the retransmission buffer; and

a retransmitting step of retransmitting packets of the general sequence numbers detected by the retransmission packet detecting step, to the reception apparatus.

5 45. The packet retransmission method of claim 39,
the reception apparatus including:

a packet providing step of providing payload (data) of at least one packet out of packets stored in the reception buffer to the request application unit,

10 deleting general sequence numbers smaller than a general sequence number of the
packet, from the retransmission-request list,

providing payload of packet of next general sequence number ($N + 1$) coming
after a general sequence number (N being a natural number) of a packet provided last time,
within a specific time, and

15 when the packet of next general sequence number ($N + 1$) does not exist in the
reception buffer and is not inserted into the reception buffer within the specific time, notifying
the request application unit of a loss of the packet to be provided.

46 The packet retransmission method of claim 44,
the reception apparatus including

20 a packet providing step, when a packet to be provided within a specific time does not
exist in the reception buffer, of performing a packet loss detection and a retransmission-request
transmission several times within the specific time.

47. The packet retransmission method of claim 44,
25 the reception apparatus including

a packet providing step, when a general sequence number of a packet to be provided does
not exist in the retransmission list, of notifying the request application unit that the packet to be
provided is lost, without waiting for the specific time having passed.

30 48. The packet retransmission method of claim 27 or claim 28,

the transmission apparatus including

a priority information adding step of adding priority information to an optional packet p coming every m packets ($m \leq n$, m and n are natural numbers), wherein the priority information is information about packets of high priority and packets to be retransmitted at a packet loss,

5 which are located in a range of n packets from the packet p, and for deciding values of m and n depending upon a network congestion status,

the reception apparatus including

10 a packet loss detecting step of detecting a sequence number of a packet of high priority which has been lost and a sequence number of packet to be retransmitted at packet loss which has been lost, based on a packet in the reception buffer and sequence number of a received packet and on the priority information, at packet receiving intervals depending upon a number of times of receiving packets and a receiving time and at every loss of important packet found based on inconsistency of sequence numbers.

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